New Record of *Lipoptena cervi* and Updated Checklist of the Louse Flies (Diptera: Hippoboscidae) of the Republic of Korea

HEUNG CHUL KIM,[1] SUNG TAE CHONG,[1] JOON-SEOK CHAE,[2] HANG LEE,[3] TERRY A. KLEIN,[4] SANG JAE SUH,[5] AND LEOPOLDO M. RUEDA[6]

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ABSTRACT This is the first confirmed record of the genus *Lipoptena* Nitzsch and its species, *Lipoptena cervi* (Linnaeus), from the Republic of Korea. A total of five females and 10 males was collected from eight of 29 Korean water deer, *Hydropotes inermis argyropus* Swinhoe, from Gangwon and Gyeongsangbuk Provinces and Ulsan Metropolitan Area from May through October 2008. An updated checklist of Korean hippoboscids contains nine species in six genera (*Hippobosca* Linnaeus, *Icosta* Speiser, *Lipoptena*, *Ornithoctona* Speiser, *Ornithomya* Lattreille, and *Ornithophila* Rondani). Hosts, collection records, and repositories are also noted.

KEY WORDS louse fly, *Lipoptena cervi*, Hippoboscidae, water deer, Korea

Both sexes of louse flies or hippoboscid flies are obligate blood-feeding ectoparasites of birds and mammals. The adults are dorsoventrally flattened and adapted for moving through the bird's plumage and the mammal's pelage, and have specialized claws that aid them to cling to the feathers or hair of their hosts. Worldwide, the family Hippoboscidae consists of three subfamilies, 21 genera, and 213 species (Dick 2006). The genus *Lipoptena* is comprised of ≈30 species (Dick 2006). Members of the genus *Lipoptena*, commonly called deer keds, are winged when they emerge from their puparia, which often remain attached to the pelage of the host or fall to the ground. After emergence, the winged louse flies seek a suitable host, whereby they break their wings off along a cleavage line and become permanently associated with that host. *Lipoptena cervi* has been reported from temperate areas of Europe, Siberia, Northern China, and North America (Maa 1969c). They are obligate parasites of elk, deer, and other bovines, sucking blood and ovipositing individual prepuparium on the host for up to 10 mo. Although little is known about the vector potential of hippoboscid flies, *L. cervi* are known to harbor and transmit *Bartonella schoenbuchensis* Dehio in deer in Germany and the United States, and animals infested with hippoboscid flies may develop a moderate to severe dermatitis (Dehio et al. 2004, Hermosilla et al. 2006, Matsumoto et al. 2008).

Except for a few early surveys of louse flies from 1922 to 1969 in the Republic of Korea (ROK), no other louse fly surveys of wild birds and large mammals have been conducted in the ROK (Okamoto 1924; Bequaert 1941; Maa 1967, 1969a, b, c; Seok 1970) (Table 1). Only eight species of louse flies were recorded earlier from birds and mammals from the ROK (Maa 1967, 1969c; Anonymous 1994).

In this study, we report the first record of the deer ked, *L. cervi*, collected from the Korean water deer, *Hydropotes inermis argyropus* Swinhoe. We also include an updated checklist of louse flies and their associated hosts in the ROK.

Materials and Methods

Ectoparasites were collected from May through October 2008 from wild deer captured for necropsy from two metropolitan areas, namely the following: Seoul (37.5898 N, 127.0041 E) and Ulsan (Yeampo-dong, 35.5276 N, 129.2924 E; Onyang-eup, 129.2961 E, 35.4234 N) and four provinces, namely the following: Gangwon-do (Cheorwon-gun, 37.0553 N, 127.2139 E), Chungcheongbuk-do (36.8931 N, 127.8469 E), Jeollanam-do (35.1176 N, 126.9367 E), and Gyeongsanbuk-do (Uljin, 3736.6009 N, 129.2628 E) in the ROK (Fig. 1), under an approved Korean wildlife animal use protocol, College of Veterinary Medicine, Seoul National University. Louse flies and ticks collected from the deer from above local-

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[1] 5th Medical Detachment, 168th Multifunctional Medical Battalion, 65th Medical Brigade, Unit 15247, APO AP 96205–5247.

[2] Research Institute for Veterinary Science and BK21 Program for Veterinary Science, Veterinary Internal Medicine, College of Veterinary Medicine, Seoul National University, Seoul 151-742, Republic of Korea.

[3] Conservation Genome Resource Bank for Korean Wildlife, College of Veterinary Medicine, Seoul National University, Seoul 151-742, Republic of Korea.

[4] Force Health Protection and Preventive Medicine, 65th Medical Brigade/USAMEDDAC-Korea, Unit 15281, APO AP 96205–5281.

[5] Department of Environmental Horticulture, College of Life Science and Natural Resources, Kyungpook National University, Sangju 742-711, Republic of Korea.

[6] Corresponding author: Walter Reed Biosystematics Unit, Division of Entomology, Walter Reed Army Institute of Research, 503 Robert Grant Avenue, Silver Spring, MD 20910–7500.

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14. ABSTRACT

This is the ?st con?med record of the genus Lipoptena Nitzsch and its species Lipoptena cervi (Linnaeus), from the Republic of Korea. A total of ?e females and 10 males was collected from eight of 29 Korean water deer, Hydropotes inermis argyropus Swinhoe, from Gangwon and Gyeongsangbuk Provinces and Ulsan Metropolitan Area from May through October 2008. An updated checklist of Korean hippoboscids contains nine species in six genera (Hippobosca Linnaeus Icosta Speiser, Lipoptena, Ornithoctona Speiser, Ornithomya Lattreille, and Ornithophila Rondani). Hosts, collection records, and repositories are also noted.

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Table 1. Checklist of the louse fly (Hippoboscidae, Diptera) species and associated hosts from the Republic of Korea

Species	*n*	Host	Type	Collection date	Location	Repository (code)	References
Hippobosca equina Linnaeus	NR	NR	Mammal	NR	Jeju Island, Jeju-do	NR	Seok (1970)
H. longipennis Fabricius	1 F	*Motacilla alba leucopsis* Gould	Bird	1925	Taiyudong	HKU	Maa (1967)
	1 F	*M. alba leucopsis*	Bird	May 1922	Seoul	HKU	Maa (1967)
	6	*M. alba leucopsis*	Bird	June 1922	Quelpart Island (=Jeju), Jeju-do	HKU	Okamoto (1924)
Icosta ardae ardae (Macquart)	1 M	*M. alba leucopsis*	Bird	NR	Chemulpo (=Inchon), Gyeonggi-do	BMNH	Maa (1969b)
Lipoptena cervi (Linnaeus)	1 F, 2 M	*Hydropotes inermis argyropus* Swinhoe	Mammal	8 May and 16 June 2008	Cheorwon-gun, Gangwon-do	FMDL	X
	3 M	*H. inermis argyropus*	Mammal	16 June 2008	Uljin-gun, Gyeongsangbuk-do	FMDL	X
	1 F, 1 M	*H. inermis argyropus*	Mammal	5 Aug. and 10 Oct. 2008	Yeampo-dong, Buk-gu, Ulsan	FMDL	X
	3 F, 4 M	*H. inermis argyropus*	Mammal	21, 23 Aug. 2008	Onyang-eup, Ulju-gun, Ulsan	FMDL, SI (1 F)	X
Ornithoctona plicata von Olfers	NR	NR	NR	NR	Unkown location, Korea	NR	Bequaert (1941), Maa (1969c)
Ornithomya avicularia aobatonis Matsumura	2 F	*Emberiza spodocephala* Pallas	Bird	Oct. 1965	Kunja	BBM (75079)	Maa (1967)
	1 F	*E. spodocephala*	Bird	Oct. 1965	Chin Chup Myun, Kyunggi-do	MAPS (6E 1044)	Maa (1967)
	1 F	*E. tristrami* Swinhoe	Bird	Oct. 1965	Nao Chon Myun, Kyunggi-do	MAPS (6E 0851)	Maa (1967)
	1 F	*E. rutila* Pallas	Bird	Oct. 1965	Chin Chup Myun, Kyunggi-do	MAPS (6E 1370)	Maa (1967)
	1 F	*Acrocephalus arundinaceus* (Temminck and Schlegel)	Bird	Aug. 1965	Chin Chup Myun, Kyunggi-do	MAPS (6E 1004)	Maa (1967)
O. chloropus extensa Maa	1 F	*E. rutila*	Bird	Oct. 1966	Chin Chup Myun, Kyunggi-do	MAPS (6E 1467)	Maa (1967)
O. fringillina Curtis	1 F	*Coccothraustes coccothraustes japonicus* Temminck and Schlegel	Bird	Nov. 1965	Seoul	NR	Maa (1967, 1969c)
Ornithophilla metallica (Schiner)	1 F	*M. alba leucopsis*	Bird	NR	Seoul	NR	Maa (1969a)

BBM, Bernice Bishop Museum, Honolulu, HI; BMNH, British Museum of Natural History, London, United Kingdom; F, female; FMDL, 5th Medical Detachment Laboratory, United States Army, Seoul, ROK; HKU, Entomology Institute of Hokkaido University, Sapporo, Japan; M, male; MAPS, Migratory Animal Pathology Survey, Honolulu, HI; NR, no available record; SI, National Museum of Natural History, Smithsonian Institution, Washington D.C.; X, this survey.

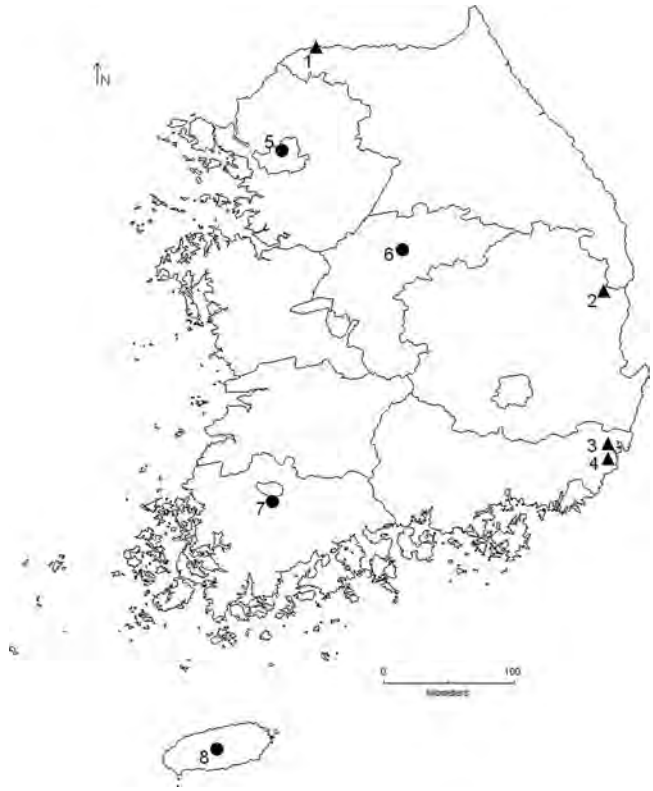

Fig. 1. Map of the ROK showing collection localities of the louse fly, *L. cervi* (triangles, with collected flies; circles, without flies; n = number of louse flies/number of infested hosts/number of examined hosts), collected from the Korean water deer, *H. inermis argyropus*. In Jeju Island, only roe deer, *C. pygargus*, was captured. (1) Cheorwon-gun, Gangwon-do (n = 3:2:4); (2) Uljin-gun, Gyeongsanbuk-do (n = 3:1:2); (3) Yeampo-dong, Buk-gu, Ulsan (n = 2:2:2); (4) Onyang-eup, Ulju-gun, Ulsan (n = 7:3:9); (5) Seoul (n = 0:0:1); (6) Chungcheongbuk-do (n = 0:0:2); (7) Jeollanam-do (n = 0:0:7); (8) Jeju Island, Jeju-do (n = 0:0:1).

ities were placed in 2-ml plastic vials with 80% ethyl alcohol and transported to the 5th Medical Detachment laboratory, where louse flies were identified under a dissecting microscope using morphological keys (Bequaert 1941; Maa 1965, 1967). Specimens were sent to the Department of Entomology, Smithsonian Institution, where the identifications were confirmed by Dr. F. C. Thompson. A voucher specimen (one adult female) was deposited at the National Museum of Natural History, Smithsonian Institution (Washington D.C.), whereas the rest of the identified samples were returned to Seoul National University for assay of selected zoonotic pathogens.

Results and Discussion

A total of 29 Korean water deer (*H. inermis argyropus*) and one roe deer (*Capreolus pygargus* Pallas) was captured from May through October 2008. A total of 15 adults (five females and 10 males) and two puparia of *L. cervi* was collected from eight Korean water deer at Gangwon and Gyeongsangbuk Provinces, and the Ulsan Metropolitan Area (Table 1; Fig. 1). Previously, only species belonging to five genera (*Ornithoctona*, *Ornithomya*, *Ornithophilla*, *Icosta*, and *Hippobosca*) of the family Hippoboscidae were reported from the ROK (Table 1).

In addition to the first record of *L. cervi* from three widely dispersed geographical locations extending from the northern demilitarized zone to the southernmost part of the ROK, we also report for the first time the occurrence of the genus *Lipoptena* in this country. Adult *L. cervi* is dorsoventrally flattened, relatively small (5–7 mm long), and brownish in color (Fig. 2). The head has distinct simple eyes (or ocelli) and well-developed maxillary palps. The thorax has 15–18 laterocentral setae on the mesonotum with spines scattered on the anterior part of prosternal lobe. Both sexes alight on a host, take a blood meal, mate, and after an indeterminate period the female will give birth to a mature larva that will begin to pupate (http://ento.psu.edu.extension/factsheets/deer-keds). In the present survey, two puparia were collected while they were attached to the pelage of deer, and the wings of all adults were broken off close to their bases.

The changing ecology (particularly reforestation) and increases in associated wildlife populations provide for great proximal host contacts and wide distribution of blood-feeding ectoparasites in the ROK. Further studies are needed to identify the geographical distributions of louse flies, including *L. cervi*, and their potential role as reservoirs of the zoonotic pathogens in the ROK. With this finding of the new occur-

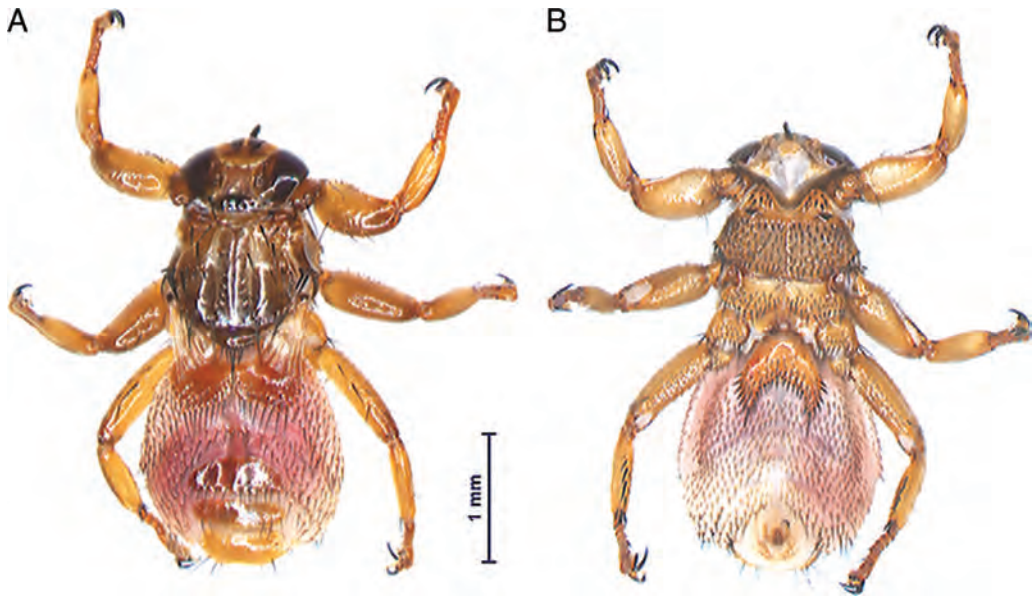

Fig. 2. Adult male *L. cervi* collected from the Korean water deer (*H. inermis argyropus*) in the ROK. (A) Dorsal view; (B) ventral view.

rence of *L. cervi* from the two provinces (Gangwon-do, Gyeonsangbuk-do) and a metropolitan city (Ulsan), prediction models may be developed to determine the potential distribution of this louse fly species, its associated mammalian host, and the risk assessment of possible hippoboscid-borne human and animal diseases in the Korean peninsula.

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